Jurnal Ekonomi Malaysia 47(2) 2013 93 - 109

The Effect of Regime Switching Policy Rules on Economic Growth

(Kesan Dasar Perubahan Regim terhadap Pertumbuhan Ekonomi)

Norlin Khalid
Universiti Kebangsaan Malaysia

Nur Fakhzan
Universiti Teknologi MARA Kedah

ABSTRACT

This paper empirically examines the relative effect of active and passive regime policy rules on economic growth. The time series data for a set of South-East Asian countries namely, Malaysia, Thailand and Singapore are used for the period 1971-2009. The Markov-switching (MSC) regression method is employed to characterize the regime switching for both monetary and fiscal policy reaction functions for each country. Then, the relative impact of these regime policies on long run output grow this estimated by using Auto Regressive Distributed Lag (ARDL) method. In order to control for different regime of policy rules, the dummy variables are included to capture the regime switching changes. The MSC regression shows that Thailand's monetary policy is mostly active while fiscal policy is mostly passive throughout the sample covered. When both policies are considered, we note that Thailand changes its policy regimes very frequently. In contrast, Singapore's regime switching is quite more stable. Singapore was in active monetary and passive fiscal for 20 years from 1971 to 1991. The country was in the passive monetary and passive fiscal regimes for 8 years before switching to passive monetary and active fiscal in year 2000 until 2009. Nevertheless, Malaysia's monetary policy regimes are characterized as passive at all times while fiscal regime is active throughout the sample study. Furthermore, the ARDL cointegration shows that both monetary and fiscal policies are important in sustaining long run economic growth for Thailand. Meanwhile, Singapore's economy is only positively determined by monetary policy while fiscal policy is insignificant. As for regime switching, our results indicate that only the monetary policy regime affects the economic growth in Thailand. This implies that an active monetary authority will only lead to a lower output growth. However, none of the regime variables is significant for Singapore which indicates that neither active nor passive regime really matters for economic growth.

Keywords: monetary policy; fiscal policy; Markov Regime Switching; economic growth

ABSTRAK

Makalah ini secara empirikal mengkaji kesan relatif perubahan rejim aktif dan pasif kepada pertumbuhan ekonomi. Satu set data siri masa untuk negara-negara Asia Tenggara iaitu Malaysia, Thailand dan Singapura digunakan untuk tempoh 1971-2009. Kaedah regresi Markov Regime-switching (MSC) digunakan untuk mencirikan peralihan rejim bagi kedua-dua fungsi tindak balas dasar monetari dan fiskal bagi setiap negara. Seterusnya, kesan relatif perubahan rejim terhadap pertumbuhan output jangka panjang dianggarkan menggunakan kaedah Autoregressive Distributed Lag (ARDL). Pembolehubah dummy dimasukkan untuk mengambilkira pertukaran rejim aktif dan pasif. Keputusan MSC menunjukkan bahawa dasar monetari di Thailand kebanyakannya aktif manakala dasar fiskal kebanyakannya pasif di sepanjang tempoh kajian. Apabila kedua-dua dasar monetari dan fiskal digabungkan, didapati Thailand mengalami perubahan rejim dasar yang sangat kerap. Sebaliknya, pertukaran dasar rejim di Singapura adalah lebih bersifat stabil. Singapura berada dalam keadaan aktif dasar monetari dan pasif dasar fiskal selama 20 tahun dari tahun 1971 hingga 1991. Seterusnya, negara ini berada dalam rejim pasif monetari dan pasif fiskal selama 8 tahun sebelum beralih kepada pasif monetari dan aktif fiskal pada tahun 2000 sehingga 2009. Berbeza dengan kes Malaysia pula dimana rejim dasar monetari sentiasa pasif dan rejim fiskal sentiasa aktif sepanjang tempoh kajian. Hasil keputusan kointegrasi ARDL pula menunjukkan bahawa kedua-dua dasar fiskal dan monetari adalah penting dalam mengekalkan pertumbuhan ekonomi jangka panjang bagi negara Thailand. Sementara itu, ekonomi Singapura hanya positif ditentukan oleh dasar monetari manakala dasar fiskal adalah tidak ketara. Berdasarkan pembolehubah dummy pertukaran regim, didapati hanya regim dasar monetari memberi kesan kepada pertumbuhan ekonomi di Thailand secara negatif. Ini bermakna dasar aktif monetari hanya akan membawa kepada pertumbuhan ekonomi yang lebih rendah di Thailand. Walau bagaimanapun, tiada pembolehubah dummy rejim didapati signifikan bagi Singapura dan seterusnya menunjukkan bahawa perubahan rejim aktif dan pasif tidak memberi kesan kepada pertumbuhan ekonomi jangka panjang.

Kata kunci: Dasar monetari; dasar fiskal; Markov Regime Switching; pertumbuhan ekonomi

INTRODUCTION

Traditionally, business cycles and economic growth are considered to be independent of each other. From the perspective of macroeconomic policy, aiming for a higher growth means accepting price instability and reaching for price stability will sacrifice economic growth. In fact, discussions on fluctuation of business cycle and long term economic growth are usually being studied separately. In other words, business cycles fluctuations do not affect long term economic growth and vice versa. This also implies that any stabilization policy such as monetary and fiscal have no long term effects on growth. Hence, the question arises here is whether there is any tradeoff between policies that are conductive to short run stabilization and those that provide a good environment for long run economic growth? Given this problem, this paper attempts to bridge the independence between short run stabilization and long run growth studies. The key idea here is the regime switching of policy rules. The regime of policy rules, i.e. 'active' and 'passive' monetary and fiscal are designed to stabilize the inflation and government debt dynamics. However, in the long run these policy regimes are expected to behave differently in the long-term growth. For instance, between the regime of 'active monetary/passive fiscal' and regime of 'passive monetary/active fiscal', which one is more efficient in sustaining long run economic growth?

Furthermore, many empirical studies have found that the policy rules are switching between active and passive. For example, Clarida et al. (2000) estimated the forward looking monetary policy reaction function for the U.S from 1960-1979 and found that the Taylor principle does not hold for U.S monetary policy. Woodford (1999), however, suggested that fiscal policy may have been active during that period, proposing that observed inflation may actually emerged from a unique equilibrium. In addition, Favero and Monacelli (2003) showed that fiscal policy was active and monetary policy was passive in the 1960s and 1970s as well as between 1987 and 2001. These empirical evidences for the U.S have shown mixed results. This implies that monetary and fiscal policies always fluctuate between active and passive regime depending on the economic cycles and shocks. Given these empirical findings, a regime switching model that allows the coefficients to switch between two states would be a better presentation of monetary and fiscal rules than the alternative of one regime (constant coefficients) model.

Following this, the purpose of this paper is to examine empirically the implications of linear feedback rules governing monetary and fiscal policy regimes on long term growth during the business cycles. To do so, we use a set of South-East Asian countries namely Malaysia, Thailand and Singapore as a sample dataset. Yearly data from 1970 to 2009 will be covered. We first need to characterize the regime switching changes throughout the sample period. This can be done by employing Markov-switching change (MSC) regression method to estimate both monetary and fiscal feedback rules for a given country. In a Markov-switching regression, switching between regimes does not occur deterministically but with a certain probability. The dynamics behind the switching process is known and driven by a transition matrix in which the regime switching shocks are treated as exogenous. The main literature of the Markov-switching model can be found in Hamilton (1994), Kim and Nelson (1999) and Wang (2003). Since the model presents here has two policy rules and two states, i.e. 'active' and 'passive', we ended up with four policy regimes which are 'active monetary/passive fiscal' (AM/PF) regime, 'passive monetary/active fiscal' (PM/AF) regime, both policies are active (AM/AF) regime and both polices are passive (PM/PF) regime. In order to classify these regime policy rules, we estimate the policy reaction function for each country by allowing the policy rules to switch between two states. This can be done by introducing a new source of disturbance to the economy. In other words, we assume that all the parameters of the rules including the error variances evolve according to a Markov process. Thus, in the policy reaction function, each variable has a discrete-valued random variable that evolves stochastically and independently of the endogenous variables. In contrast to a fixed regime policy, there is a stochastic process governing the dynamic evolution of the policy reaction function under a regime switching model.

Once the policy regime changes have been characterized, the next step is to study the effect of policy regime changes on long run economic growth. To do so, we use the Autoregressive Distributed Lag (ARDL) model to investigate the long run relationship between the series of the variables. In order to control for different regime of policy rules, the dummy variables are included to capture the regime switching changes. This could provide some possible explanations on why some countries at certain period prefer to pursue 'active' monetary and 'passive' fiscal, while others prefer to follow policies of 'passive' monetary and 'active' fiscal as a coherent growth strategy to achieve long run economic growth with a stable price.

LITERATURE REVIEW

The role of monetary and fiscal policy on economic growth is an old topic and has been discussed extensively in macroeconomics since the debate between Monetarist and Keynesian's schools of thoughts. Despite the effectiveness of these policies on economic growth had been widely discussed either theoretically or empirically, all of these researches only considered the policy rules under a fixed regime. None of the literature specifically discussed the effect of policy rules when the policies are switched between active and passive policy rules. This is crucial, as many previous empirical studies have found that over the time, policy rules associated with monetary and fiscal are switching between active and passive. Thus, a regime-switching model is a better presentation of policy rules than a fixed regime model.

Earlier economists who studied the effect of policy rules on economic growth had formulated the St. Louis equation in examining the relative effectiveness of monetary and fiscal (Anderson and Jordan (1968) was the first proposed St. Louis equation). The findings from this equation are that monetary policy has greater, faster and more predictable impact on economic activity. However, a number of critiques have questioned the validity of St. Louis equation due to its controversial conclusion of fiscal policy ineffectiveness. First, this equation suffers from specification error as it omits some other relevant regressors. Second, critics have claimed that the use of ordinary least square has resulted in simultaneous equation bias. In addition, critics are concerned that the policy variables included in this equation are also not statistically exogenous. Thus, the results obtained using the St. Louis equation could be biased and inconsistent (Stein (1980), Ahmed et al. (1984) and Batten and Thornton (1986)). Following that, some authors, such as Darrat (1984) and Rahman (2005), have modified the St. Louis equation to overcome the problem of omitted variables by including the real interest rates and Batten and Haffer (1983) by taking into account an open economy.

Following St. Louis equation, this topic has been discussed empirically by using different countries and datasets, model specification as well as econometric methodology. For instance, a study by Melitz (2002) on nineteen OECD countries, which used pooled regression showed that monetary and fiscal policies act as substitutes as they move into opposite directions. Hughes-Hallet (2005) investigated the interactions between monetary and fiscal policy rules in the UK and Europe. By using individual instrumental variables regressions, he found that both policies act as substitute in the UK but complements in the Europe. Muscatelli et al. (2004) estimated a forward-looking New-Keynesian model for the US using quarterly data from 1970Q1 to 2001Q2 by using the generalized method of moment estimation. They found that monetary policy smoothes, fulfills the Taylor principle and responds to output in a stabilizing manner. Each part of fiscal policy smoothes government spending responds in a destabilizing manner to contemporaneous output, but in a stabilizing manner to lagged output, making the overall response just counter-cyclical.

Recent paper by Ali et al. (2008) used panel data for four Southeast Asian countries. They employed ARDL bound testing to estimate long run relationship between policy instruments and economic growth. They found that the money supply, proxied by broad money, is significant in both short and long run while the fiscal balance for fiscal policy is insignificant. In addition, the other study by Khosrari et al. (2010) using the same method of ARDL bound testing for Iran found the variable for fiscal policy, which is government expenditure, has a significant impact on GDP growth while inflation and exchange rate have a negative sign on GDP.

From previous studies, we could see that studies that have utilized the same techniques for different data sets and countries have produced mixed results, and hence the relative power of monetary and fiscal on economic growth remains an empirical issue. Furthermore, all of these studies analyze the role of policy rules under a fixed regime policy. Although there have been some papers that incorporate regime switching policy specification into dynamic stochastic general equilibrium models, they only consider a one-time changein regime (Sims (1997), Woodford (1998), Loyo (1999), Mackowiak (2006), Weil (2002) and Daniel (2003) who studied fiscal theory of price level determination). In addition, some authors consider only the changes in fiscal regime while holding monetary policy fixed (Loyo (1999), Weil (2002) and Daniel (2003)). On the contrary, this paper considers that both monetary and fiscal policy rules are switching between active and passive regime overtime. This can be done by introducing a new source of disturbance to the economy. In other words, we assume that all the parameters of the rules including the error variances evolve according to a Markov process. Thus, in the policy reaction function, each variable has a discrete-valued random variable that evolves stochastically and independently of the endogenous variables. Next, the various types of policy reaction function will be discussed.

The reaction function is used to evaluate the actions and policy of an authority in response to the economic environments. The interest among economists in estimating policy reaction functions has increased dramatically to capture the policy regime changes. Despite the huge number of studies on reaction functions of various countries and samples, the researchers have not been successful in providing an accurate representation of the monetary and fiscal authority's behavior. For instance, Khoury (1990) surveyed 42 such empirical monetary regime changes from various studies while surveying 15 empirical evidences on fiscal regime changes.

The fiscal policy reaction function was first tested by Bohn (1998) for US. He considered the dynamic feedback from the level of government debt to future government surpluses, the temporary deviation of the government expenditure from its targeted level divided by GDP and GDP gap. According to this reaction function, the classification of active and passive regime is made based on the coefficient on the level of government debt to future government surpluses. Since the primary surplus is likely to fall during economic downturns, it is suspected that primary surplus responds positively to this variable. In his study, he showed that there is a positive reaction of primary surplus to initial debt ratio. This implies that the U.S's fiscal policy is sustainable and satisfies the budget constraint in the sense that it responds by increasing its primary surplus whenever the government runs a budget deficit and eventually leads to excessive debt to GDP. The other explanatory variables such as GDP gap attempts was included to capture the fluctuations of the primary surpluses coming from the automatic stabilizer function of the government budget. In addition, it is suspected that the budget balance can worsen to finance a temporary surge in the government expenditure and thus the temporary deviation of the government expenditure from its targeted level divided by GDP was also included to explain the variations in the government surpluses.

Starting from Bohn (1998)'s fiscal reaction function, few literatures have modified this policy reaction function as variations from the basic approach. For example, Doi et al. (2011) modified Bohn (1998)'s specification by including the AR (1) to allow the smoothed adjustment of primary surplus. Favero and Monacelli (2005) recommended a specification of the fiscal policy rule aimed at capturing a gradual convergence of the fiscal instrument, which is primary deficit to some targeted level. This spirit is similar to the one adopted for the estimation of so-called Taylor rules for monetary rules. In their model specification, target deficit responses to two main arguments. The first is the output gap in capturing a cyclical component of fiscal policy. The second is debt-stabilizing deficit or the level of primary deficit that would be consistent at each point in time with constant government debt. In this context, the elasticity of the primary deficit to the debt-stabilizing deficit reflects the distinction between active and passive fiscal rule. This allows the controlling of the time-varying effects of interest rate and growth rate of GDP on the debt service component of the deficit. In contrast to the previous literatures, Davig and Leeper (2007) proposed another fiscal feedback reaction function in which the tax revenue to GDP is used as a fiscal policy instrument instead of primary surplus. They specified the tax revenue to GDP ratio as a function of the debt to GDP ratio, output gap, and government purchases. In this type of policy reaction function, the fiscal policy alternates between active and passive phase characterized by a positive coefficient on the debt to GDP ratio.

In the case of monetary policy reaction functions, most of the previous literatures used Taylor reaction functions to characterize the policy regime equilibrium in which interest rate responds to inflation and output gap. For instance, Davig and Leeper (2007) analyzed the consequences of regime switching for determinacy of Taylor reaction functions by assuming all the parameters of the rules including the error variances evolve according to Markov process. Woodford (2001) modified the Taylor rule by including an open economy. He expressed the policy instrument, i.e. the interbank interest rate as a function of the output gap, inflation target, the exchange rate and lagged of interest rate. Here the lagged interest rate is introduced to capture the inertia in optimal monetary policy, as specified by Woodford (2001). In addition, in estimating the policy rules for Japan, Doi et al. (2011) employed a modified Davig and Leeper (2007) specification by taking open economy into account by including the deviation of the real exchange rate from its trend in the specification.

Given these reaction functions, we can conclude that there are various policy instruments that can be applied in order to characterize the regime switching. However note that, some of these policy reaction functions discussed the policy rule individually, either fiscal or monetary policy only. Yet, some studies such as Doi et al. (2011) and Davig and Leeper (2007) have considered both policy rules to classify regime switching. In this study, the policy reaction function by Doi et al. (2011) will be employed since the primary surplus is used as an instrument of fiscal policy instead of tax variables as used by Davig and Leeper (2007). The reason is because there are substantive issues that have to be resolved about the definition of the tax rates. For instance, lump sum taxes, direct versus indirect taxes and different measures of the tax rate such as statutory taxes or income-weighted marginal income tax rate, which all are giving different measurements to tax variable. In this case, this issue becomes more difficult as this study involves many countries and some data on taxes are not available. Consequently, we use primary surplus for estimating fiscal policy reaction function.

METHODOLOGY

As has been noted, the primary deficit will be used as an instrument to estimate a fiscal policy feedback rule. We employed fiscal policy reaction function by Bohn (1998) and its modified version by Doi et al. (2011); where they specified the dynamic feedback from the level of government debt (b_{t-1}) to future government surpluses (x_t):

$$x_t = \alpha(s_t^f) + \beta(s_t^f)b_{t-1} + \rho(s_t^f)x_{t-1} + \gamma(s_t^f)g_t + \delta(s_t^f)y_t + \sigma(s_t^f)u_t \tag{1}$$

where x_t is the ratio of primary deficit to output and b_{t-1} is lagged debt-to-output ratio. g_t is the temporary deviation from the trend level of government spending divided by GDP and u_t is the disturbance with i.i.d N(0,1). Notice that here, the main difference between a fixed regime and regime switching policy rules is a new source of disturbance denoted as s_t^f, i.e. a stochastic process governing the dynamic evolution of the rules. This is the reason why the policy is called policy rules instead of policy instrument under a fixed regime policy. Under a regime switching policy, a discrete-valued random variable, s_t^f is exogenous and evolves stochastically and independently of the endogenous economic variables. Under this type of policy rule, we also allowed the variance of the errors to switch between two state values.

The classification of active and passive regimes is made based on the coefficient of initial debt ratio on the primary surplus. If the primary surplus responds positively to initial debt ratio, then fiscal policy is sustainable and satisfies the budget constraint in the sense that it responds by increasing its primary surplus whenever the government run a budget deficit that leads to an excessive debt to GDP ratio. Therefore, in line with the terminology by Leeper (1991), we classified fiscal policy as 'passive' when primary surplus respond positively to initial debt ratio in the sense that it has to satisfy the budget constraint. Similarly, the fiscal policy was classified as 'active' if primary surplus responds negatively to initial debt ratio.

Basically, a balanced budget may deteriorate if it were to finance a temporary surge in the government expenditure without jeopardizing the long run sustainability. Thus, it is suspected that the primary surplus responds negatively to this variable. y_t is the GDP gap which attempts to capture the fluctuations of the primary surplus coming from the automatic stabilizer function of the government debt. Since the primary surplus is likely to fall during economic downturns, it is suspected that primary surplus responds positively to this variable.

For the case of monetary policy reaction function, this study used Doi et al.'s (2011) version to analyze the consequences of regime switching for determinacy of equilibrium in which interest rate (r_t) responds to inflation (π_t), outputgap (y_t) and the deviation of the real exchange rate from its trend (e_t):

$$r_t = \alpha(s_t^m) + \beta(s_t^m)\pi_t + \gamma(s_t^m)y_t + \gamma(s_t^m)e_t + \sigma(s_t^m)u_t \quad (2)$$

We estimated the Markov-switching rules by assuming all the parameters of the rules including the error variances evolve according to a Markov process. In this policy reaction function, the monetary policy is called 'active'ifthecoefficientontheinflationrateisgrea ter thanzero;i.e.an'active'monetary authority needs to maintain a targeted inflation rate.

Equations (1) and (2) will be estimated using a Markov-switching regression method to characterize the regime switching changes overtime. According to Marcelo Perlin (2010), this method assumes that the transition of states is stochastic and not deterministic. This implies that one is never sure whether there will be a switch of state or not. However, the dynamics behind the switching process are known and driven by a transition matrix. This matrix will control the probabilities of making a switch from one state to the other. It can be represented as:

$$\text{p} = \begin{bmatrix} p_{11} & \cdots & p_{1k} \\ \vdots & \ddots & \vdots \\ p_{k1} & \cdots & p_{k1} \end{bmatrix}$$

where, the element in row i, column $j(p_{ij})$ controls the probability of a switch from state j to state i. To illustrate, consider that for sometime t the state of the world is equal to 2 as the policy rules switch between active and passive regimes. This implies that the probability of as witch from state 2 to state 1 between time t and $t + 1$ will be given by p_{12}. Likewise, a probability of staying in state 2 is determined by p_{22}. This is one of the central points of the structure of a Markov regime switching model, that is, the switching of the states of the world is a stochastic process itself. In this paper we assume that the transition probabilities are constant. This Markov-switching model can be estimated by maximum likelihood using Hamilton's filter and iterative algorithms (the main literature of the Markov-switching model can be found in Hamilton (1994), Kim and Nelson (1999)).

In the next step after characterizing regime switching changes for policy rules, the long run implication of regime switching policy rules on economic growth will be examined. In doing so, the Autoregressive Distributed Lag (ARDL) technique as proposed by Pesaran and Pesaran (1997), Pesaran and Smith (1998), Pesaran and Shin (1999) and Pesaran et al. (2001) will be used. In this specification, we explicitly model the policy rules that change overtime between active and passive regimes. The presence of regime switching was controlled by introducing dummy variables D_i in which i = M, N for monetary (DM) and fiscal (DF) respectively.

There are three steps in estimating long run relationship between monetary and fiscal policy rules on economic growth. The first step is to estimate the long run relationship among the series of the variables. The significance of the lagged levels of the variables in the error correction form of the underlying ARDL model will be tested. The ARDL model can be written as follows:

$$\begin{aligned}\Delta\ln Y_t = \rho_0 + \lambda_1 \ln Y_{t-1} + \lambda_2 \ln MP_{t-1} + \lambda_1 \ln FP_{t-1} + \\ \sum_{i=1}^{p} \alpha_i \Delta\ln Y_{t-i} + \sum_{i=0}^{q} \beta_i \Delta\ln MP_{t-i} + \\ \sum_{i=1}^{r} \delta_i \Delta\ln FP_{t-i} + \gamma_1 DF_t + \gamma_2 DM_t + \varepsilon_t \quad (3)\end{aligned}$$

where ln Y_t is GDP, MP is monetary rule, FP is fiscal rule; while DF and DM are the dummy variables for fiscal and monetary policies, respectively. All the variables are expressed in natural logarithm. The selection of the optimum lagged orders of the ARDL (p,q,r) model is based on the Schwarz Bayesian criteria,which is known to be parsimonious in its lag selection. The ARDL regression yields an F-statistic which can be compared with the critical values as tabulated by Narayan (2004) for the small sample size data. The long run relationship was tested by conducting the ARDL bound test with the null hypothes is of no cointegration. The joint hypotheses to be tested are: $H_0: \lambda_1 = \lambda_2 = \lambda_3 = 0$ against the alternatives $H_1: \lambda_1 = \lambda_2 = \lambda_3 = 0$. If the test statistic is above the upper critical value, the null hypothes is of no long run relationship can be rejected regardless of whether the order of integration of inflation and the nominal interest rate are I(0) or I(1). In contrast, if the test statistic is below a lower critical value, the null hypotheses cannot be rejected. If, however, the test statistic falls between these two bounds, the result is inconclusive.

In the second step, once the cointegration has been established, the conditional ARDL (*p, q, r*) long-run model of the determinants of the output growth can be estimated as below:

$$\ln Y_t = \rho_0 + \sum_{i=1}^{p} \alpha_{i-1} \ln Y_{t-i} + \sum_{i=0}^{q} \beta_i \Delta \ln MP_{t-i} + \sum_{i=1}^{r} \delta_i \Delta \ln FP_{t-i} + \gamma_1 DF_t + \gamma_1 DM_t + \varepsilon_t \quad (4)$$

In the final step, after we tested for the presence of cointegration, we estimated the short run dynamic parameters by estimating an error correction model (ECM) associated with the long run estimates. This is specified as following form:

$$\Delta \ln Y_t = \rho_0 + \upsilon_1 ECM_{t-1} + \gamma_2 DF_t + \gamma_2 DM_t + \sum_{i=1}^{p} \alpha_i \Delta \ln Y_{t-i} + \sum_{i=0}^{q} \beta_i \Delta \ln MP_{t-i} + \sum_{i=1}^{r} \delta_i \Delta \ln FP_{t-i} + \varepsilon_t \quad (5)$$

Where υ_1 measures the speed of adjustment andis the first difference operator. ECM_t is the error correction term that is defined as:

$$ECM_t = \ln Y_t - \rho_0 - \sum_{i=1}^{p} \alpha_i \Delta \ln Y_{t-i} - \sum_{i=0}^{q} \beta_i \Delta \ln MP_{t-i} - \sum_{i=1}^{r} \delta_i \Delta \ln FP_{t-i} \quad (6)$$

DATA

This paper uses annual data set that covers the period 1971 - 2009 for a set of South-East Asian countries namely, Malaysia, Thailand and Singapore. Despite the non-existence of study that characterizes regime switching of monetary and fiscal policies, these four countries were chosen as they have common economic characteristics and demographic changes. For instance, in 1997 all of these countries were affected by the Asian financial crisis. Therefore it would be interesting to study the behavior of policy rules with respect to business cycle and economic growth.

The nominal gross domestic product (GDP) is used as a proxy of income. The primary surplus was defined as the difference between the revenue and the spending excluding interest payments on its debt. The primary surplus to GDP ratio is obtained by dividing the primary surplus with GDP. In addition, the real debt to GDP ratio is lagged debt-to-output ratio measured by market value of privately held gross debt divided by nominal GDP. Real government expenditure is CPI adjusted general government final consumption expenditure that includes all government current expenditures for purchases of goods and services. The policy instrument, real interest rate is calculated from the average of lending and deposit rates minus expected inflation. To obtain a potential output estimates, output is detrended and the residuals are used as output gap estimates. The potential output is calculated using the method proposed by Hodrick and Prescott (1997) filter. In order to use this filter, we set lambda = 100 since this study uses a yearly data. This choice is still considered appropriate as Kydland & Prescott (1990) suggested that lambda = 400 for annual data and lambda = 1600 for quarterly data. Inflation rate is measured as the annual change in the Consumer Price Index (1995 = 100). Finally, the real exchange rate gap is the deviation of the real exchange rate from its trend. All of the variables used such as primary surplus, output, inflation, government debt, government spending, interest rates and exchange rates are gathered from the International Government Statistics Yearbook by IMF and Asian Development Bank data sets. For the second part of the analysis, the fiscal policy is proxied by the government expenditure while monetary policy is proxied by the Broad Money. The broad money is the sum of currency outside bank demand deposits other than those of the central government, the time, savings and foreign currency.

EMPIRICAL RESULTS

MARKOV REGIME SWITCHING (MRS) REGRESSION

Using Markov regime switching regression, we estimated Equations (1) and (2). Table 1 and 2 report the estimation results by using maximum likelihood estimation (MLE) for both monetary and fiscal, respectively. For the fiscal policy reaction function, the policy is defined as active or passive depending on the coefficient estimate on the lagged of the debt to GDP ratio. On the other hand, monetary policy regime is determined by the feedback of real interest rates on inflation rates or the so-called Taylor rule. Since the feedback rule is expressed in terms of real and not nominal, the critical value of Taylor coefficient is equal to zero and not unity. The policy is 'active' if coefficient of inflation rate is greater than zero and vice versa.

It is interesting to notice that, Thailand's monetary policy was mostly active while its fiscal policy was mostly passive throughout the sample of the study. This can be seen in Figure 1 and 2. When both policies are considered, the monetary and fiscal regimes are found to be alternating between active and passive over time (Table 3). As a result, the changes in policy regimes between periods occurred very frequently. In contrast,

TABLE 1. Estimation results for Markov Switching Monetary Policy Rule

Dependent variable: REAL INTEREST RATES	Thailand		Singapore		Malaysia	
	Regime 1	Regime 2	Regime 1	Regime 1	Regime 2	Regime 1
Constant	0.0637* (0.0091)	0.1075* (0.0033)	0.0590* (0.0032)	0.0244* (0.0050)	0.0704* (0.0039)	0.0358* (0.0015)
Inflation	0.2138 (0.1367)	-0.3072* (0.0303)	0.0634 (0.0488)	-0.3718 (0.2432)	0.0647 (0.0654)	0.0204 (0.0451)
GDP gap	0.2038** (0.0782)	-0.0376 (0.0324)	0.2331* (0.0741)	0.0753 (0.0706)	0.1196* (0.0336)	0.0991** (0.0411)
Real exchange rate gap	-0.0005 (0.0014)	0.0387* (0.0017)	0.0247 (0.0291)	-0.0448 (0.0455)	-0.0034 (0.0076)	0.0050 (0.0043)
Variance	0.0009* (0.0002)	0.0000 (Inf)	0.0001** (0.0000)	0.0002** (0.0001)	0.0001* (0.0000)	0.0000* (0.0000)
Log-likelihood	78.5065		105.8727		116.5337	
Regime switching changes	1971-1973 1976-1987 1990-2005	1974-1975 1988-1989 2006-2009	1971-1991	1992-2009	1970-1997	1998-2009

Notes: Estimated by the Maximum Likelihood (MLE) assuming normality. Numbers in parentheses are standard errors.

TABLE 2. Estimation Results for Markov Switching Fiscal Policy Rule

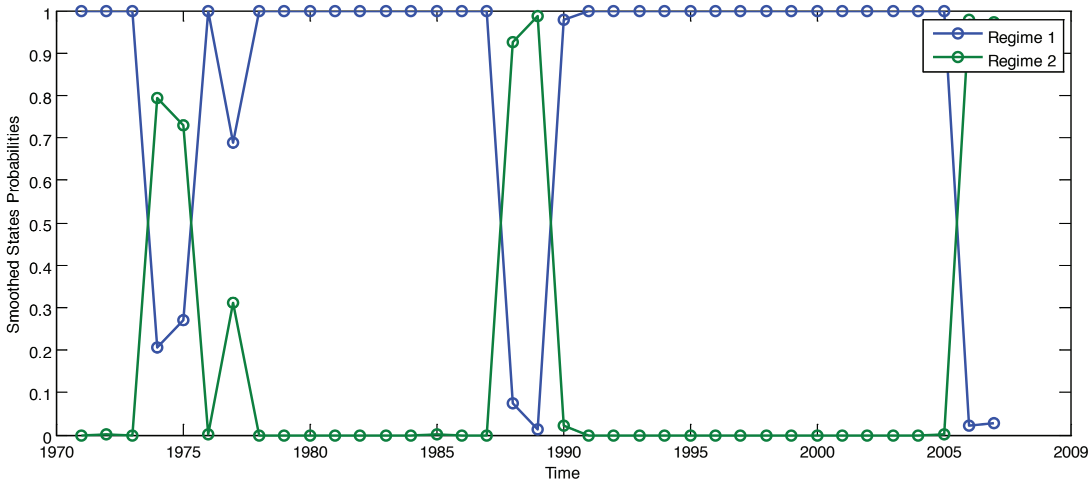
Dependent variable: Primary deficit/GDP	Thailand		Singapore		Malaysia	
	Regime 1	Regime 2	Regime 1	Regime 2	Regime 1	Regime 2
Constant	-0.0015 (0.0092)	-0.0163*** (0.0085)	0.0349 (0.0214)	0.2331 (0.1828)	-0.0281* (0.0082)	0.0141** (0.0058)
Lagged (debt/GDP)	0.0173 (0.0351)	-0.1088** (0.0398)	0.1325* (0.0367)	-0.1205 (0.1745)	-0.1182* (0.0227)	-0.0703*** (0.0382)
Lagged dependant variable	0.7449* (0.0897)	-1.2139* (0.2040)	-0.2096 (0.1803)	-0.8772*** (0.4324)	0.2268* (0.0669)	1.1075* (0.1634)
GDP gap	-0.1532* (0.0433)	-0.2533* (0.0468)	0.0769** (0.0332)	0.0661 (0.0820)	-0.2822* (0.0286)	0.0851*** (0.0460)
Government expenditure/ GDP	0.1036 (0.0692)	0.6074* (0.0827)	-0.1592** (0.0660)	0.4931* (0.1331)	0.1853* (0.0392)	-0.0576 (0.0744)
variance	0.0001* (0.0000)	0.0000*** (0.0000)	0.0005* (0.0001)	0.0003*** (0.0002)	0.0001** (0.0000)	0.0001** (0.0000)
Log-likelihood	105.6242		82.3479		103.7039	
Regime switching changes	1971-1973 1977-1980 1984-1996 2001-2009	1974-1976 1981-1983 1997-2000	1970-1999	2000-2009	1972-1987 1997 2003-2009	1970-1971 1988-1996 1998-2002

Notes: Estimated by the Maximum Likelihood (MLE) assuming normality. Numbers in parentheses are standard errors.

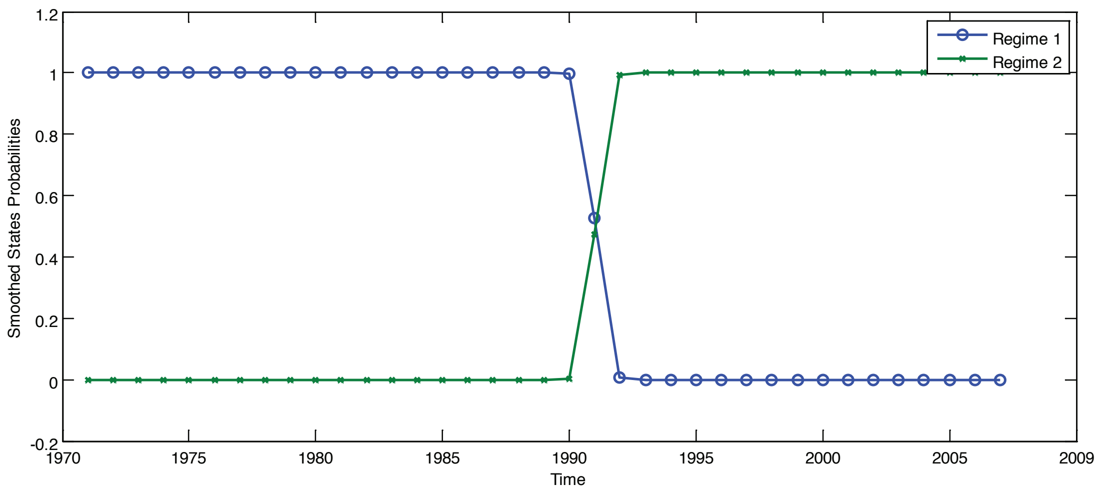
Singapore's regime switching was more stable as it did not show very frequent change in regime policy rules. In terms of timing of regime changes, Singapore was in Regime AM/PF for 20 years from 1971 to 1991 and was about eight years in regime PM/PF before switching to regime PM/AF from year 2000 until 2009. The results for Malaysian economy are totally different from Thailand and Singapore. Malaysia's monetary policy regimes can be characterized as passive at all times while fiscal regime was active at all times.

LONG-RUN OUTPUT GROWTH IMPLICATION

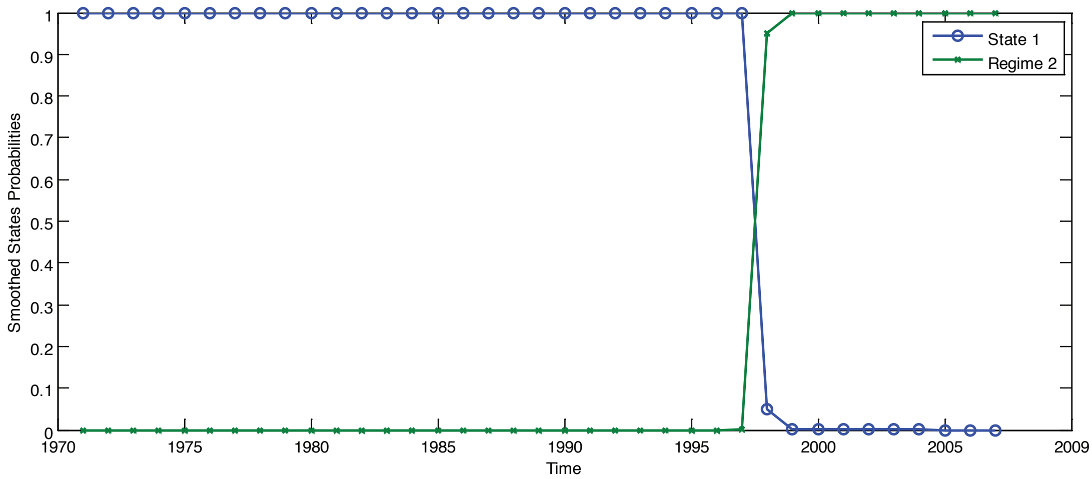
Based on the result obtained in Markov regime switching regression, we demonstrate that there is ongoing regime switching practice for both monetary and fiscal in Thailand and Singapore. Thus, our aim is to investigate the effectiveness of these policy rules in sustaining output growth when these policies are switching overtime. However, with regard to Malaysia's policy rules, we found that the dummy policy variables did not vary over time since only the monetary policy was active and



Thailand's Probability of Regime 1 (Active) and Regime 2 (Passive) in a Two-Regime MRS Estimation of the Monetary Policy Rule

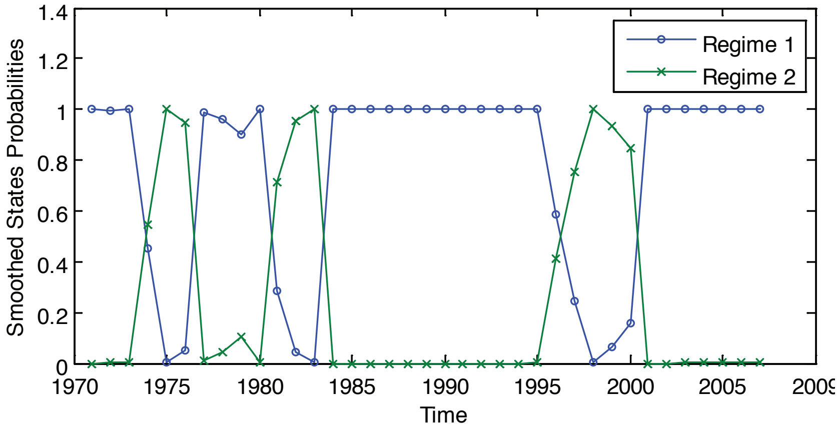


Singapore's Probability of Regime 1 (Active) and Regime 2 (Passive) in a Two-Regime MRS Estimation of the Monetary Policy Rule

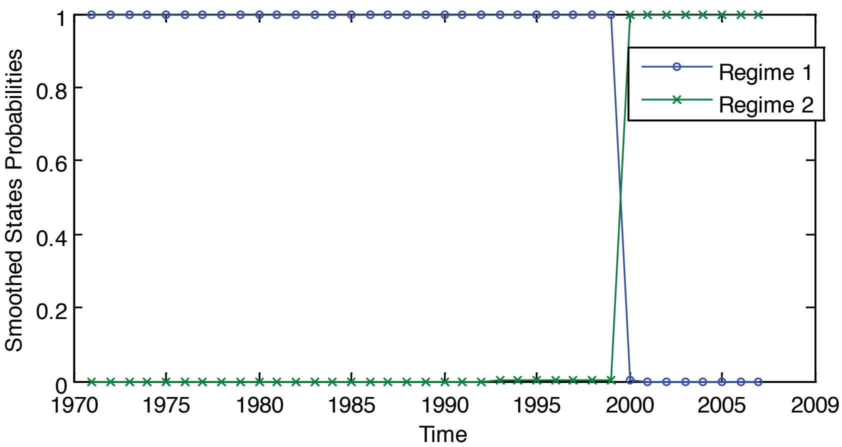


Malaysia's Probability of Regime 1 (Passive) and Regime 2 (Passive) in a Two-Regime MRS Estimation of the Monetary Policy Rule

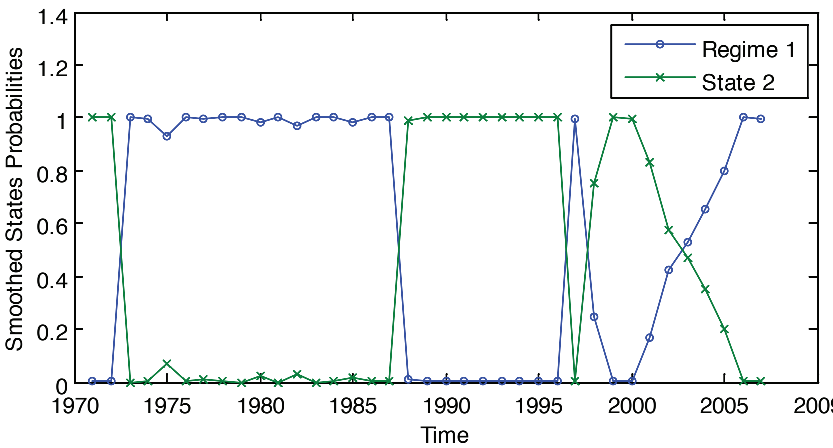
FIGURE 1. Probability of Regime Switching in Monetary Policy Rule



Thailand's Probability of Regime 1 (Passive) and Regime 2 (Active) in a Two-Regime MRS Estimation of the Fiscal Policy Rule



Singapore's Probability of Regime 1 (Passive) and Regime 2 (Active) in a Two-Regime MRS Estimation of the Fiscal Policy Rule



Malaysia's Probability of Regime 1 (Active) and Regime 2 (Active) in a Two-Regime MRS Estimation of the Fiscal Policy Rule

FIGURE 2. Probability of Regime Switching in Fiscal Policy Rule

TABLE 3.Classification of Regime Policy Rules for both Monetary and Fiscal

	Thailand	Singapore	Malaysia	
1971	1	1	2	Note:
1972	1	1	2	*Regime 1 - Active Monetary/Passive Fiscal*
1973	1	1	2	*Regime 2 - Passive Monetary/Active Fiscal*
1974	2	1	2	*Regime 3 - Active Monetary/Active Fiscal*
1975	2	1	2	*Regime 4 - Passive Monetary/Passive Fiscal*
1976	3	1	2	
1977	1	1	2	
1978	1	1	2	
1979	1	1	2	
1980	1	1	2	
1981	3	1	2	
1982	3	1	2	
1983	3	1	2	
1984	1	1	2	
1985	1	1	2	
1986	1	1	2	
1987	1	1	2	
1988	4	1	2	
1989	4	1	2	
1990	1	1	2	
1991	1	1	2	
1992	1	4	2	
1993	1	4	2	
1994	1	4	2	
1995	1	4	2	
1996	1	4	2	
1997	3	4	2	
1998	3	4	2	
1999	3	4	2	
2000	3	2	2	
2001	1	2	2	
2002	1	2	2	
2003	1	2	2	
2004	1	2	2	
2005	1	2	2	
2006	4	2	2	
2007	4	2	2	
2008	4	2	2	
2009	4	2	2	

fiscal policy was passive over the sample period of study. Therefore, long run implication of regime switching policy rules on output growth cannot be analyzed for the case of Malaysia as this will result in perfect multi collinearity. Consequently, we only analyzed the effect of monetary and fiscal policy under a fixed regime policy. Specifically, from equation (3), the model for Malaysia is estimated without having dummy variables for regime switching (DF and DM).

Using an ARDL approach, equation (3) was estimated to examine the relative effectiveness of regime policy rules on economic growth. Prior to the testing of long run relationship, the unit root test was conducted to test the order of integration, I, for each variable using the Augmented Dickey-Fuller (ADF) approach. Even though the ARDL method of cointegration does not require pre-testing variables, the unit root test can be used to convince whether or not the ARDL model should be used. As can be seen in Table 4 for Thailand, Singapore and Malaysia in panel i), ii) and iii) respectively, the results showed that there is a mixture of I(0) and I(1) of underlying variables. This implies the ARDL testing is the best method to test for the existence of long run relationship between the series of the variables.

TABLE 4. Unit Root Test using ADF (Augmented Dickey Fuller)

Country/ variable	At Level I(0)		First Difference I(1)	
	Constant	Constant with Trend	Constant	Constant with Trend
i) Malaysia				
LNY	-2.9647*	-1.8917	-3.9295*	-4.7790*
LNM	-2.1557	-3.1093	-4.8783*	-5.3951*
LNG	-1.1940	-2.4226	-3.7007*	-3.8446*
DB	-0.6579	-2.0111	-4.2426*	-4.2321*
ii) Singapore				
LNY	-2.1134	-1.9626	-3.3688	-3.7575*
LNM	-1.2664	-1.6256	-3.7063*	-4.0161*
LNG	-2.7714	-1.9202	-4.4377*	-5.4877*
DF	-0.5615	-1.7940	-4.2426*	-4.3137*
DM	-0.8918	-2.0706	-4.2426*	-4.1762*
DB	-0.6579	-2.0111	-4.2426*	-4.2321*
iii) Thailand				
LNY	-2.9152	-1.8074	-3.1262*	-4.5054*
LNM	-2.9278	-0.5178	-1.6405	-2.7717
LNG	-2.2755	-1.6230	-3.6947*	-4.3062*
DF	-3.4450*	-3.6067*	-4.0620*	-4.0260*
DM	-3.2096*	-3.2390	-6.2809*	-6.2736*
DB	-0.6579	-2.0111	-4.2426*	-4.2321*

Note: (*), (**) and (***) indicate significant at 1%, 5% and 10% significance level respectively

We then test for the existence of long run relationship between the series of the variables. Table 5 provides the results of the F-statistics for each country to various lag orders. The critical value is also reported in Table 5 based on the critical value suggested by Narayan (2004) for a small sample size between 30 and 80. As can be seen from Table 5, the test outcome of the significance levels for the long run relationship varies with the choice of lag-length. For Thailand, the computed F-statistics are significant, at least at 0.95 levels when the order of lags is 3, while the F-statistics for Singapore is significant at least at 0.95 and 0.99 levels when the lag order is 3 and 4, respectively. This implies that the null hypothesis of no cointegration is rejected and therefore there is a cointegration relationship among the variables. In this case, the ECM version of the ARDL model is an efficient way in determining the long run relationship among the variables. Consequently, there is a tendency for the variables to move together towards a long-run equilibrium. Conversely, no cointegration is found for the case of Malaysia for the entire lag orders used in this study. This finding implies that under a fixed regime policy in Malaysia, there is no long run

TABLE 5.F-statistics for Testing the Existence of a Long run Equation

Countries	*F*- statistics	Lag	Significance Level	Bound Critical Values* (restricted intercept and no trend)	
				I(0)	I(1)
Malaysia	1.7727	2			
Thailand	3.1453	2	1 %	4.030	5.463
Singapore	3.2685	2			
Malaysia	1.4799	3			
Thailand	4.6585**	3	5 %	2.928	4.042
Singapore	4.8254**	3			
Malaysia	3.1161	4			
Thailand	2.9151	4	10 %	2.458	3.432
Singapore	6.4994*	4			

Note: * Based on Narayan (2004)

relationship between the policy instruments and economic growth.

Having found a long run relationship for Singapore and Thailand, we estimated the long run model from equation (4) by normalizing the output growth. Since the sample observations are annual data from 1971 to 2009, the maximum order of lags, i.e. two were chosen as suggested by Pesaran and Shin (1999) and Narayan (2004). From this condition, the lag length that minimizes Schwarz Bayesian criterion (SBC) is selected. Based on SBC criteria, the ARDL (1, 0, 0) and ARDL (2, 0, 0) models are obtained for Singapore and Thailand respectively. These results for the long run estimates are summarized in Table 6. In the long run, both monetary and fiscal policies have a significant effect on output or GDP for Thailand. Every 1 per cent increase in money supply yields an average 0.48 per cent improvement in output and 1 per cent increase in government spending yields 0.36 per cent improvement in output. In terms of regime switching policy rules, only the dummy for monetary policy (DM) is significant while the dummy for fiscal policy (DF) is insignificant. The coefficient for monetary policy dummy that takes into account of active and passive policy is negative and statistically significant determinant of output at 5 per cent critical value. This implies an active monetary authority will only lead to a lower output growth; however the coefficient size is quite small.

On the other hand, only monetary policy is significant and has a positive effect on economic growth for the case of Singapore. The coefficient is relatively high at 0.97. This implies that a 1 per cent increase in broad money leads to a 0.97 per cent increase in output. However coefficients for fiscal policy and both dummies for monetary and fiscal are not statistically significant in changing output in the long run. This finding suggests that in the long run, Singapore's economic growth is not affected by the changes in regime policy rules. The output growth is only determined by monetary policy through its money supply while fiscal policy is not effective in sustaining output growth in the long run.

TABLE 6. Estimation of Long Run Coefficients

Country/ ARDL(p,q,r)	Singapore ARDL(1,0,0)	Thailand ARDL(2,0,0)
Dependent variable: LNY		
Constant	3.2409* (0.8461)	2.9879* (0.2831)
LNG	-0.2699 (0.3292)	0.3644* (0.0942)
LNM	0.9717* (0.2768)	0.4807* (0.0706)
DF	-0.0619 (0.1086)	-0.0029 (0.0268)
DM	0.0110 (0.1713)	-0.0637** (0.0277)

Note: (*), (**) and (***) indicate significant at 1%, 5% and 10% significance level respectively. Numbers in parentheses are standard errors

The results of the ECM-ARDL for the short run analysis are reported in Table 7. For Thailand, most of the coefficients in the short run are significant except for the dummy for fiscal policy. The significance of dummy for monetary regime indicates that monetary regime switching is significant in determining Thailand's economy growth for both short run and long run. Yet, the coefficient is negative and small. This implies that, an active monetary authority has led to lower economic growth. However, the impact of the monetary and fiscal policy on economic growth is almost the same for Thailand in the short run and long run. In the short

TABLE 7. Estimation of Short Run (VECM) Model – Thailand

Panel A: Estimated Model		
	Singapore	Thailand
Dependent variable: D(LNY)	ARDL(1,0,0)	ARDL(2,0,0)
Constant	0.9921** (0.4362)	1.6596* (0.2988)
ECT_{t-1}	-0.3061*** (0.1618)	-0.5555* (0.1343)
$D(LNY)_{t-1}$		0.4951* (0.1108)
D(LNG)	-0.0826 (0.0711)	0.2024** (0.0874)
$D(LNG)_{t-1}$		
D(LNM)	0.2975** (0.1146)	0.2670* (0.0606)
$D(LNM)_{t-1}$		
DF	-0.0189 (0.0328)	-0.0016 (0.0148)
DM	0.0034 (0.0651)	-0.0354** (0.0148)
Panel B: Diagnostic Testing		
Serial Correlation[a]	1.6388 [0.210]	0.7195 [0.403]
Functional Form[b]	6.6969** [0.015]	0.0463 [0.831]
Normality[c]	2.3521 [0.308]	1.4596 [0.482]
Heterocedasticity[d]	5.5654 [0.324]	0.1168 [0.735]

Note: ARDL (1,0,0) lag for each variable is selected based on AIC. Dependent variable is D(LNY). (*), (**) and (***) indicate significant at 1%, 5% and 10% significance level respectively. [a]Lagrange multiplier test of residual serial correlation; [b]Ramsey's RESET test using the square of the fitted values; [c]Based on a test of skewness and kurtosis of residuals; [d]Based on the regression of squared residuals on squared fitted values.

run, these coefficients are 0.2024 and 0.2670 for fiscal and monetary policies, respectively; and the signs are consistent with the macroeconomic theory. The result for Singapore contradicts Thailand's in which none of the dummies for regime switching is significant. Therefore, the classification of active and passive policy authority is not important in affecting economic growth. Similar to long run, only monetary policy is significant in the short run but the coefficient is relatively small.

As shown by Table 7, the error correction terms (ECT_{t-1}) for both countries are significant and has the negative sign. Specifically, the estimated values of ECT are equal to -0.5555 and -0.3061 for Thailand and Singapore respectively. In other words, the significance of ECT suggests that more than 55 and 31 percent of disequilibrium caused by previous years shock will be corrected in the current year and converges back to long run equilibrium for Thailand and Singapore respectively. These findings show that the speed of adjustment is really high especially for Thailand. We applied a number of diagnostic tests to the ECM in order to check for the robustness of the model. From the table we can see that both models for Thailand and Singapore have no evidence of serial correlation and heteroscedasticity effect in the disturbances. Both models also passed the Jarque-Bera normality test which suggests that the errors are normally distributed. By using Ramsey Resets test for functional form, we found that Thailand's model specification is well specified whereas Singapore has a problem of functional form. However, this is not crucial as the model is believed to be an accurate form of policy specification from economic theories perspective in this study.

Besides, we also performed variance decompositions (VDC) and impulse response functions (IRF) to evaluate the dynamic interaction and strength of causal relations between the policy rules and output growth. Derived from an estimated VAR, the VDC and IRF could give more information in terms of the relative strength of policy to economic growth. However, it is important to note that by using VAR there is a possibility that the VAR innovations are contemporaneously correlated. Consequently, the isolated shocks to individual variables cannot be identified. Thus, making it difficult to represent the response of a variable to innovations in other variables of interest (Lutkepohl 1991). As a result, the Cholesky factorization that orthogonalizes the innovations is used as suggested by Sims (1980) to solve the identification problem. The idea is to pre-specify causal ordering of the variables since the results from VDC and IRF may be sensitive to the variables' ordering if the error terms' contemporaneous correlations are high. Based on this factorization, the ordering of variables started with the most exogenous variable in the system and ended by the most endogenous variable.

To see whether the ordering could be a problem, we checked the contemporaneous correlations of VAR error terms. This can be seen in Table 8 and 9 in the Appendix for Singapore and Thailand, respectively. The results for Singapore showed that there are very low correlations between the errors terms as mostly are less than 0.2. This implies that for the case of Singapore, the results of IRF and VDC are not sensitive to the variables' ordering. However, to perform VDC and IRF we arrange the variables according to the following order: LNY, LNM and LNG. Similarly, the VAR errors terms for Thailand are generally low but relatively, the correlations are quite high between LNY and LNG as well as between LNG and LNM. Based on this, we arranged the ordering of the variables to the order LNG, LNY and LNM for the case of Thailand.

The results of IRF are shown in Figure 3 and 4 for Singapore and Thailand respectively. From these figures, we can see that the IRF can produce the time path of dependent variables in the VAR to shocks from all the explanatory variables. For both countries, it is clear from the diagrams that for any of the dependent variables, any shock from the explanatory variables makes the impulse response dies out to zero although Thailand took even longer than Singapore. This result suggests that for both countries, the system of equation in the model is a stable system. In addition, we can also see the directions of variables' responses to innovations in the system. For the case of Singapore, the output growth does react significantly to government spending innovations as it responds positively for the first 25 years and then subsides to zero afterwards. Although this result does not support the long run equation, it is consistent with the theory. Increase in aggregate demand, i.e. government spending, will lead to higher output growth. The output growth also responds significantly to broad money. At the beginning it responds positively to a shock in broad money and then it responds negatively before it subsides to zero after 15 years. This result will therefore support the neutrality of money in the long run. This finding is contradictory in the case of Thailand. At the beginning, Thailand's output growth does react significantly to government spending

TABLE 8.Contemporaneous Correlations of VAR Error Terms for Singapore

	LNY	LNG	LNM
LNY	1.000000		
LNG	-0.097137	1.000000	
LNM	-0.106983	0.014205	1.000000

TABLE 9. Contemporaneous Correlations of VAR Error Terms for Thailand

	LNY	LNG	LNM
LNY	1.000000		
LNG	0.290418	1.000000	
LNM	0.034732	-0.272007	1.000000

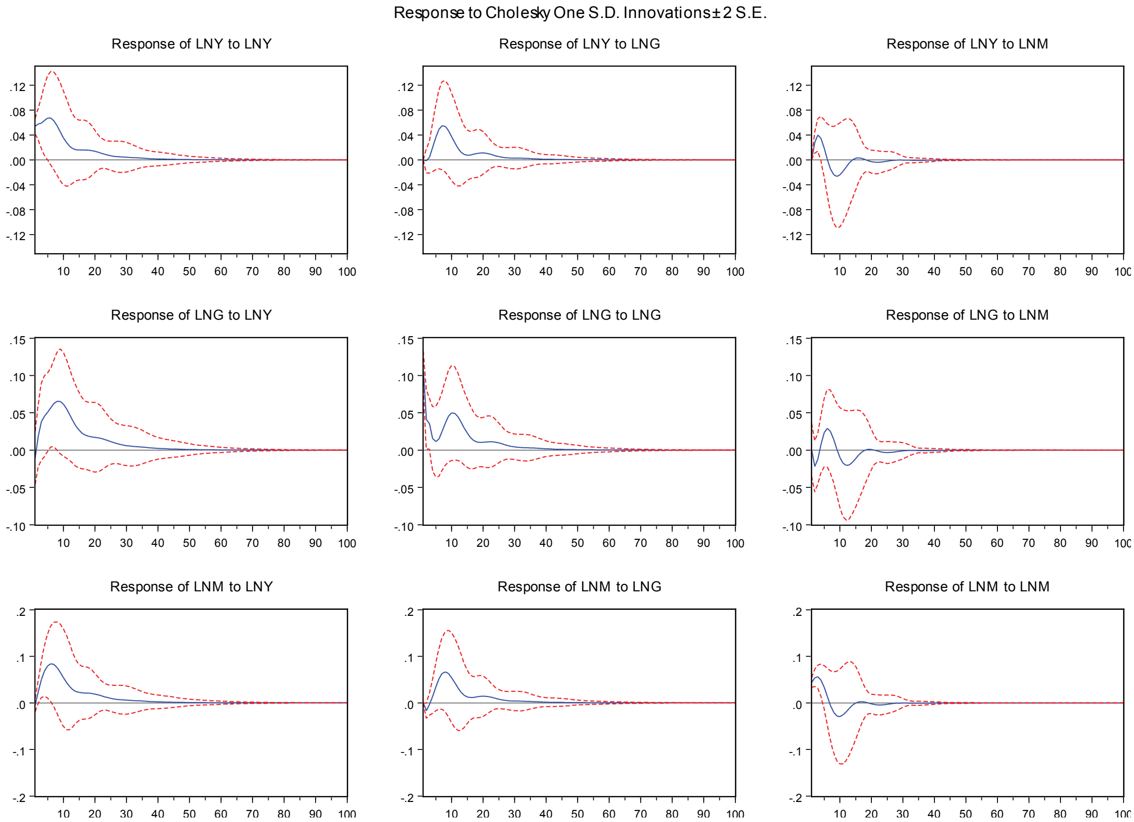


FIGURE 3. Impulse Response Functions for Singapore

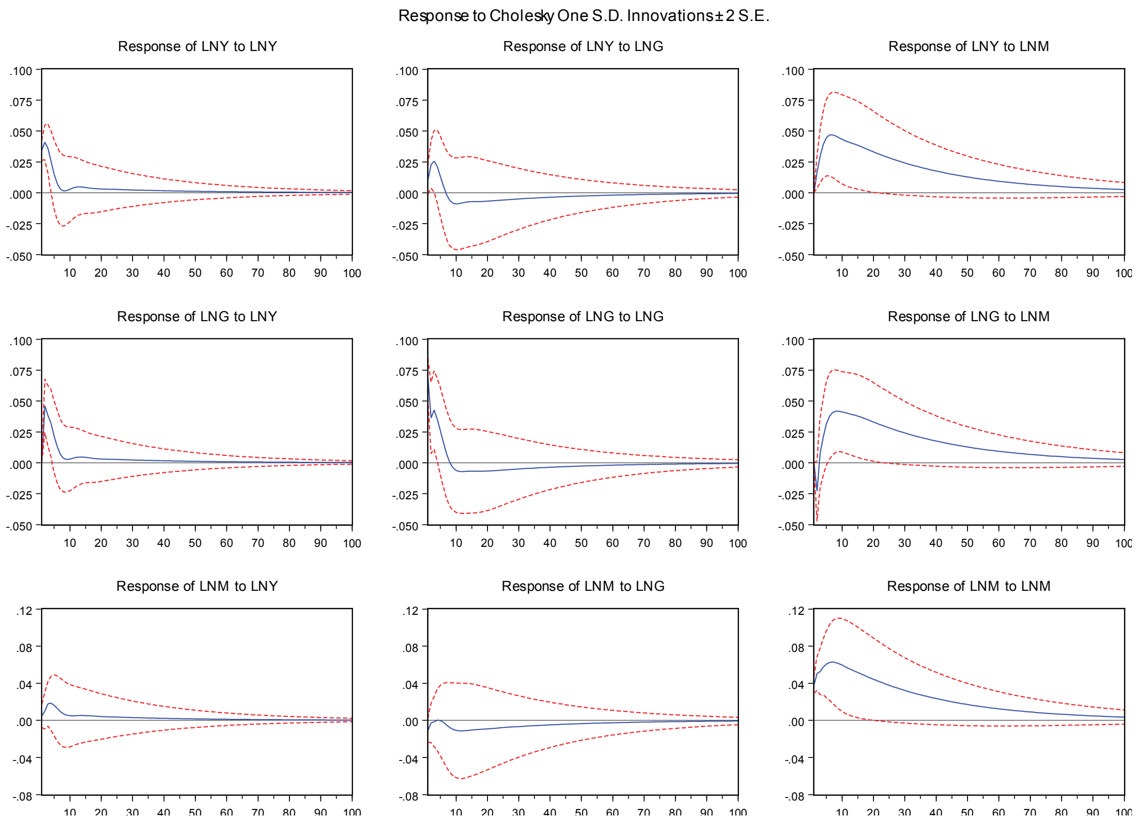


FIGURE 4. Impulse Response Functions for Thailand

innovations but then after 5 years, it responds negatively before subsides to zero after 50 years. This result supports both the short and long run equations and is consistent with the theory. As for the innovations in monetary policy, the output growth reacts positively at all time periods and takes a longer time to stabilize. This result again supports the result obtained in the ARDL model.

Apart from IRFs, the VDC can also be used as an alternative method to examine the effect of monetary and fiscal policy shocks to the output growth. It shows how much of the forecast error variance for any variable in a system is explained by innovations to each variable, over a series of time horizons. Normally, own variable shocks explain most of the error variance, although the shock will also affect other variables in the system. In this case, the VDC substantiate the significant role played by LNG and LNM in accounting for fluctuations in country's GDP growth (LNY). Initially, at 1-year horizon, most of the Thailand's LNY forecast error variance attributable to variations in its own shock and LNG with 91.5 per cent and 8.43 per cent, respectively (Table 10). However, the explanatory power of all variables, namely LNG and LNM, increases at 3-year horizon in which the percentage of output growth forecast variance explained by innovations in LNM is higher than those explained by LNG. This result supports the earlier findings that monetary policy (LNM) has a significant role in sustaining output growth while fiscal policy (LNG) has an insignificant role in determining the output growth for Thailand.

TABLE 10. Variance Decompositions – Singapore

Percentage of forecast variance explained by innovations in:			
Period	LNY	LNG	LNM
i) Variance Decomposition of LNY			
1	100.0000	0.000000	0.000000
3	80.11730	0.170470	19.71223
5	76.27482	7.248931	16.47625
10	62.63845	25.94556	11.41599
15	61.91810	26.59395	11.48795
20	62.12895	26.67260	11.19845
ii) Variance Decomposition of LNG:			
1	0.943561	99.05497	0.001471
3	11.13755	85.16319	3.699259
5	28.93796	65.62668	5.435360
10	51.43009	42.64159	5.928318
15	50.88953	42.46809	6.642386
20	51.56993	41.97104	6.459027
iii) Variance Decomposition of LNM:			
1	1.144527	0.000000	98.85547
3	27.32537	2.619336	70.05530
5	51.83531	6.088750	42.07594
10	55.05796	26.44274	18.49930
15	54.41861	27.88874	17.69264
20	54.98953	27.89423	17.11623

For Singapore, at 1-year horizon, all forecast error variances in LNY are explained by their own innovations at 100 per cent (Table 11). However, as we move further to 3 and 5-year horizon, the innovations in LNM has increased dramatically to 19.7 per cent and 16.4 per cent respectively. In 5-year horizon, only 7.2 per cent innovation in LNY is explained by LNG. Therefore, this result again supports the finding for ARDL model. However, after 5-year horizon, as can be seen from the Table, the percentage of forecast error variance in LNY explained by LNG is higher than LNM. This implies monetary policy has greater impact on output growth for the first 5 years but not afterward.

TABLE 11. Variance Decompositions - Thailand

Percentage of forecast variance explained by innovations in:			
Period	LNY	LNG	LNM
i) Variance Decomposition of LNY			
1	91.56576	8.434241	0.000000
3	63.08823	19.54950	17.36228
5	43.32554	16.57955	40.09490
10	22.90830	9.637513	67.45419
15	16.87863	7.976608	75.14476
20	14.06871	7.240038	78.69125
ii) Variance Decomposition of LNG:			
1	0.000000	100.0000	0.000000
3	29.85558	65.28322	4.861207
5	30.09324	57.98223	11.92454
10	20.63699	39.39597	39.96704
15	16.01117	30.73498	53.25384
20	13.59986	26.38646	60.01368
iii) Variance Decomposition of LNM:			
1	1.412532	7.398787	91.18868
3	6.038370	1.734972	92.22666
5	7.052982	0.855017	92.09200
10	4.048460	1.247176	94.70436
15	3.044781	2.062753	94.89247
20	2.634553	2.414902	94.95054

CONCLUSION

Monetary and fiscal policies are always switching overtime between regime of active and passive in order to counter the effect of inflation and depression as well as to achieve economic growth. Therefore, a regime switching model that allows the coefficient to shift between the two states would be a better presentation of monetary and fiscal rules than the alternative of one regime (constant coefficients) model. In this study, we work in an environment in which both monetary and fiscal policy rules evolve according to Markov process; and investigate how this environment can affect the long run economic growth. This paper uses the annual data of

Malaysia, Thailand and Singapore for the period 1971-2009 for the objective of assessing the effectiveness of different regime of 'active' versus 'passive' monetary and fiscal feedback rule in achieving long run economic growth. Using the Markov-switching (MSC) regression, we found that Thailand's monetary policy was mostly active while fiscal policy was mostly passive throughout the sample covered. When both policies are considered, we note that Thailand's changes in policy regimes between periods very frequently. In contrast, Singapore's regime switching is quite more stable. Singapore was inactive monetary and passive fiscal regime for 20 years from 1971 to 1991and it was in regime passive monetary and passive fiscal for 8 years before switching to passive monetary and active fiscal in year 2000 until 2009. Nevertheless, Malaysia's monetary policy regime can be characterized as passive at all times while fiscal regime was active throughout the sample study. Given these results, the relative effectiveness of these regime policies on long run output growth was examined by using auto regressive distributed lag (ARDL) model. For the case of Thailand, both monetary and fiscal policies through their instruments, namely broad money and government spending, are important in sustaining its long run economic growth. For Singapore's case, on the other hand, findings showed that only monetary policy affects its long run growth. Results for the regime switching showed that only dummy for monetary authority is significant for Thailand; indicating that an active monetary policy will only lead to a lower output growth. Nevertheless, in the case of Singapore, none of the dummy variables was significant, which implies that the characterization of policy authority, neither active nor passive is important in its growth strategy. For Malaysia, as its monetary regime was passive and fiscal regime was active all the time, the long run implication of regime switching policy rules on output growth cannot be analyzed.

REFERENCES

Ahmed, et al. 1984. St. Louis equation restrictions and criticisms revisited. *Journal of Money, Credit and Banking* 16: 514-520.

Anderson, L. & Jordan, J. 1968. Monetary and fiscal actions: A test of their relative importance in economic stabilization. *Federal Reserve Bank of St. Louis Review* 11-24.

Ansari, M.I., 1996. Monetary vs. fiscal policy: Some evidence from vector autoregression for India. *Journal of Asian Economics* 677-687.

Banerjee et al. 1993. *Cointegration, Error Correction and the Econometric Analysis of Non-Stationary Data.* Oxford: Oxford University Press.

Bardsen, G. 1989. Estimation of long run coefficients in error correction models. *Oxford Bulletin of Economics and Statistics* 51 (2): 345-350.

Bohn, H. 1998. The behavior of U.S. public debt and deficits. *Quarterly Journal of Economics* 113: 949-963.

Chari, V. & Kehoe, P. 1998. Federal Reserve Bank of Minneapolis Staff Report. 251.

Chowdhury, A. 1988. Monetary policy, fiscal policy and aggregate economic activity: Some Further evidence. *Applied Economics* 63-71.

Clarida, R., Gali, J. & Gertler, M. 1998. Monetary policy rules in practice: Some international evidence. *European Economic Review* 42(6): 1033-1067.

Davig, T. & Leeper, E. M. 2007. Fluctuating macro policies and the fiscal theory. *NBER Macroeconomics Annual 2006* 21: 247-298.

Davig, T. & Leeper, E. M. 2011. Monetary-fiscal policy interactions and fiscal stimulus. *European Economic Review* forthcoming.

Doi, T., Hoshi, T. & Okimoto, T. 2011. Japanese government debt and sustainability of fiscal policy. *Journal of the Japanese and International Economies* 25(4): 414-433.

Engle, R. F. & Granger, C. W. 1987. Cointegration and error correction model: Representation, estimation and testing. *Econometrica* 55(2): 251-276.

Favero, C. A. & Monacelli. 2003. Monetary-fiscal mix and inflation performance: Evidence from the US. CEPR Discussion Paper 3887.

Favero, C. A. & Monacelli. 2005. Fiscal policy rules and regime. In *Stability: Evidence from the US*. Manuscript, IGIER.

Friedman, M. & Meiselman, D. 1963. *The Relative Stability of Monetary Velocity and the Investment Multiplier in the United States, 1887-1957 in Stabilization Policies.* Englewood: Prentice Hall.

Hodrick, R. & Prescott, E. C. 1997. Postwar U.S. business cycles: An empirical investigation. *Journal of Money, Credit, and Banking* 29 (1): 1-16.

Ito, A., Watanabe, T. & Yabu, T. 2011. Fiscal policy switching in Japan, the U.S., and the U.K. *Journal of the Japanese and International Economies*, forthcoming.

Leeper, E. M. 1991. Equilibria under 'active' and 'passive' monetary and fiscal policies. *Journal of Monetary Economics* 27(1): 129-147.

Lutkepohl, H. 1991. *Introduction to Multiple Time Series Analysis*. Berlin: Springer-Varlag.

Melitz, J., 2002. Some Cross-Country Evidence about Fiscal Policy Behaviour and Consequences for EMU. In *The Behaviour of Fiscal Authorities*, edited by M.Buti, J.von Hagen and C.Martinez-Mongay. Palgrave: Basingstoke.

Moreira, T. S., Souza, G. S. & Almeida, C. L. 2007. The fiscal theory of the price level and the interaction of monetary and fiscal policies: The Brazilian case. *Revista Brasileira de Econometria* 27: 1.

Muscatelli, V. A., Tirelli, P. & Trecroci, C. 2004. Fiscal and monetary policy interactions: Empirical evidence and optimal policy using a structural New-Keynesian model. *Journal of Macroeconomics* 26(2): 257-280.

Narayan, P. K. 2004. Reformulating Critical Values for the Bound F-statistics Approach to Cointegration: An Application to the Tourism Demand Model for Fiji, Discussion Paper, Department of Economics, Monash University, Australia.

Pesaran, M. Hasem & Bahram Pesaran. 1997. *Working with Microfit 4.0: Interactive Econometric Analysis*. Oxford: Oxford University Press.

Pesaran, M. Hasem & Smith, R. P. 1998. Structural analysis of cointegrating VARs. *Journal of Economic Survey* 12 (5): 471-505.

Pesaran, M. Hasem, Shin, Y. & Smith, R. J. 2001. Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics* 16(3): 289-326.
Sims, C. A.,1980. Macroeconomics and reality. *Econometrica* 48: 1-48.
Stein, S.H., 1980. Autonomous expenditures, interest rate stabilization, and the St. Louis equation. *The Review of Economics and Statistics* 3: 357-363.
Woodford, M. 1999. *Comment on Cochrane's 'A Frictionless View of U.S. Inflation', NBER Macroeconomics Annual*. 330-419, Cambridge: MIT Press.
Yunus, A. & Miguel, A. L-L. 2005. Interest Rates and Output in the long-Run. Working Paper Series No. 434, European Central Bank.

Norlin Khalid
School of Economics
Faculty of Economics and Management
Universiti Kebangsaan Malaysia
43600 Bangi Selangor
Malaysia
nrlin@ukm.my

Nur Fakhzan Marwan
Faculty of Business Management
Universiti Teknologi MARA
UiTM Kedah, 08400 Merbok
Kedah
Malaysia